

HEALTH CARE WASTE MANAGEMENT IN IMMUNISATION PROGRAMS: GUIDANCE FOR PROPOSAL PLANNING

GUIDANCE DOCUMENT



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ACRONYMS & ABBREVIATIONS

| | | | |
|-------------|------------------------------|---------------|------------------------------------|
| BAT | best available techniques | MOH | Ministry of Health |
| BEP | best environmental practices | UNEP | United Nations Environment Program |
| Gavi | Gavi, the Vaccine Alliance | UNDP | United Nations Development Program |
| GEF | Global Environment Facility | UNICEF | United Nations Children's Fund |
| HCW | health care waste | WHO | World Health Organization |
| HCWM | health care waste management | WM | Waste management |
| MOE | Ministry of Environment | | |

DEFINITION OF KEY TERMS

Best Available Techniques

The most effective and state-of-the-art approaches to preventing and, where that is not feasible, generally reducing releases of chemicals and biological hazards and their impact on the environment (Stockholm Convention).

Best Environmental Practices

The application of the most appropriate combination of environmental control measures and strategies (Stockholm Convention).

HCWM System

A holistic range of activities for effective management of health care waste to ensure sound practices, including processes, technology and by people.

Maturity Model

A tool used to engage stakeholders to identify the current effectiveness of HCWM in the country. The model serves as a benchmark to gauge improvements over time and identify priority areas for investment.

Waste Treatment

The purpose of treatment is to reduce the potential hazard posed by health care waste while endeavouring to protect the environment. Treatment systems consider waste characteristics, technology capabilities and requirements, environmental and safety factors, and costs.

EXECUTIVE SUMMARY

As immunisation increasingly reaches more people, health care waste (HCW) also grows. Certain types of HCW can pose significant environmental and public health risks due to its toxic, infectious, and other hazardous properties. This guide encourages countries to address health care waste management (HCWM) through a coordinated effort across many entities within the Ministry of Health (MOH), Ministry of Environment (MOE), other government units, local authorities responsible for waste management, partners, and even the private sector.

This guide was designed to help you to prepare and plan your HCWM system, and to clarify your country's HCWM status to help you develop proposals for funding and investment from an immunisation perspective. This guide includes the following information:

- » An overview of HCWM policy and practice.
- » A HCWM maturity model to assist a country and partners in a strategic assessment to determine where the country is in terms of HCWM maturity and to identify and plan activities to improve HCWM status.
- » Examples of available tools and procedures for best and innovative practices, and promising technologies for improved HCWM.
- » Recommendations for countries when preparing for applications for resource investment.



KEY ASPECTS IN PLANNING SUSTAINABLE HEALTH CARE WASTE MANAGEMENT INTERVENTIONS

- » **Conduct a high level strategic assessment** using the HCWM maturity model to identify key gaps and challenges in the current HCWM system, considering the people, processes and technology involved in HCWM. Use the Assessment Tool in [Annex 1](#) and the maturity model in [Annex 2](#).
- » **In any proposal for financial support**, plan for immediate actions to address many of the common barriers, for example: implement an operational level assessment (if not recently completed); reinforce health care worker knowledge and behavior through integrated training and supervision; conduct an inventory of existing treatment equipment and technologies and their utilization; upgrade and expand waste treatment technologies where necessary.
- » **Identify and engage key stakeholders** from different ministries, government entities, and private sector for WM system planning.
- » **Consider the preferred technology** and equipment for WM based on the key principles in sustainable WM to fill the gaps in the current system.
- » **As a step in implementing WM activities**, identify opportunities for other forms of investment and collaboration across sectors.

Countries should consider using this guide together with HCWM planning and technical tools to prepare for any resource investment. You will find details and examples of best and innovative practices, and promising technologies for improved HCWM across health services and interventions as you review this guide. Your system should be based on real needs and a vision of the future for growth, innovations and opportunities for improvements across all areas of the HCWM system.

INTRODUCTION

THE CONTEXT

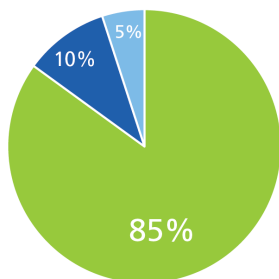
Health care waste (HCW) is a growing concern across all health areas, including immunisation. Certain types of HCW can pose significant environmental and public health risks due to its toxic, infectious, and other hazardous properties. As such it must be safely managed in order to avoid adverse health effects and safeguard the environment while ensuring quality health care and safety.

Most countries have adopted WHO standards and international agreements for health care waste management (HCWM) at the national policy level, yet often policies are not strictly followed in practice at the sub-national level for a variety of reasons. Research indicates insufficient adherence to good HCWM practices in many places, from inadequate segregation of waste to outdated disposal techniques. One study estimates that at least 50 percent of the world population is threatened by environmental, occupational, and public health

risks due to poor HCWM practices.^{i, ii, iii, iv} Additionally, many national policies, guidance, technologies, and approaches need to be updated to reflect the new technology available and improved understanding of the environmental impact of health care waste. For the best outcomes, national waste management (WM) systems—including HCWM—need to incorporate the best available techniques (BAT) and the best environmental practices (BEP).

Immunisation activities generate waste that include non-hazardous waste (such as covers for syringes, boxes, papers, etc.) and hazardous ones (syringes including needles, vaccine vials, and cotton/wool for cleaning). As each country begins looking at its immunisation WM system, it's important to also recognize that immunisation activities are part of the overall health system, and that HCWM must be coordinated across many units and departments, curative/medical procedure and preventive services, and often even the private sector. No single approach will resolve all of your country's HCWM challenges, given the variability in geographic differences. Environmental, economic, regulatory, social, and cultural factors, will determine what technologies, policies, and HCWM practices are most appropriate in specific contexts.

Typical waste composition in health-care facilities (WHO 2014)



- Non-hazardous:** Administrative, kitchen and housekeeping functions of health care facilities, and packaging from health care products
- Infectious:** Sharps waste human blood and blood products, laboratory waste, etc. Most immunisation waste falls into this category with sharps
- Chemical Radioactive:** Radioactive diagnostic and treatment materials

ABOUT THIS GUIDE

With new technologies available and a growing understanding of how to reduce risks related to HCWM, it is critical to use a structured approach to assessing your HCWM system and to identify gaps affecting the people, processes, and technologies that will improve waste management. **This guide was designed to help you to prepare and plan your HCWM system, and to clarify your country's HCWM status to**

help you develop proposals for funding and investment from an immunisation perspective. The document provides a step-by-step process to help you identify where to invest resources to improve the overall HCWM system.

This guide brings together existing guidance on assessing and planning for HCWM to prepare for any investment proposal. Use this guide and the Assessment Tool ([Annex 1](#)) during strategic planning and review sessions, such as Joint Appraisals, annual health/immunisation workplan development, or when preparing for a proposal, such as for Health Systems and Immunisation Strengthening or for New Vaccine Introduction programs. The expectation of this process is to ensure that waste management is considered within the overall health system by bringing together stakeholders from across all areas involved in waste management: the Ministry of Health, Ministry of Environment, other government entities, local authorities responsible for WM, partners, and the private sector. See [Annex 3](#) for an exhaustive list of key stakeholders who should be effectively engaged during the process to develop a sustainable HCWM system. This guide does not endorse any specific technology or company, but rather promotes best management approaches and best available technologies and equipment that reduce health and environmental risks.

The guide provides lists of tools and country examples that stakeholder groups can use to identify their country's status in terms of immunisation HCWM, advance HCWM within the overall health care system, and improve or strengthen waste management elements and practices.

Look for the innovative ideas for your HCWM system throughout this document.



BEST AND PROMISING PRACTICES

- » **As a best practice**, proper segregation of waste using a uniform colour-coding system (see the [WHO Blue Book](#)) can greatly reduce the amount of hazardous waste for disposal, thus reducing costs and creating a safer environment. Though the colour-coded containers can support adherence to waste segregation, segregation also largely depends on knowledge, understanding, and adherence to standards by health workers and waste handlers.
- » **Outdated equipment and technologies**, such as pit burning and low-burning incinerators, are no longer recommended yet are still largely in use in some places, resulting in the release of hazardous gases and compounds, creating safety hazards and worsening climate change. New technologies, such as high-temperature incinerators with pollution control or treatment and shredding of needles, reduce these risks and are considered best practices, but come at a high cost, posing sustainability challenges.
- » **Technology advances** are leading to more innovative approaches to reuse and recycle some waste. For example, glass can be broken down to be used in building roads; waste sorting technologies such as magnets or sorting machines are now available; and the steel from needles cut away from syringes can be melted down and reused after proper treatment. These approaches largely depend on resources available in your country and the broader municipal or local waste management system.

AVAILABLE TOOLS

While this guide can provide the high level overview for planning your HCWM system, there are many other tools and resources for HCWM assessment, operational planning, budgeting, and best practices, many of which can be found on [TechNet-21](#).

| | |
|------------|---|
| PEOPLE | <p><u>WHO: Training for Mid-Level Managers (MLM), Module 9: Immunisation Safety</u></p> <p>One module within WHO's highly respected MLM Training, it describes how to ensure every vaccination is given safely, how to manage waste materials, and how to monitor and adverse events.</p> |
| | <p><u>WHO: Safe Management of Wastes from Health-Care Activities</u></p> <p>Provides guidance for safe HCWM to encourage countries to move towards use of best available techniques (BAT) and best environmental practices (BEP).</p> |
| PROCESSES | <p><u>WHO: HCWM Rapid Assessment Tool (RAT)</u></p> <p>Looks at several national-level aspects including management, policy and regulatory framework, financing, training, information systems, and technological development. Information collected can be used for multi-year strategic planning.</p> |
| | <p><u>UNDP: Individualized Rapid Assessment Tool (I-RAT)</u></p> <p>Intended for use at the individual health care facility level, looking at availability of guiding documents, levels of training among staff, and prevailing WM practices. The tool can also be used as a quality improvement tool.</p> |
| | <p><u>UNICEF: Platform to Jointly Design and Implement a Sound Immunisation Waste Management System</u></p> <p>Assists decision maker to cluster facilities around treatment and disposal equipment and sites, estimate technology and budgetary needs based on waste generated, and identify sites for equipment location for HCWM of the immunisation program.</p> |
| | <p><u>Global Fund: National Capacity Planning Tool</u></p> <p>Assists in creating awareness of best practices and identifying gaps for national WM capacity and implementing best practices of WM.</p> |
| | <p><u>Healthcare Without Harm: Guidance to Develop Healthcare Waste Management Plan</u></p> <p>Describes what is required when developing the healthcare facility's waste management plan.</p> |
| | <p><u>UNEP/WHO: Preparation of National Health-Care Waste Management Plans in Sub-Saharan Countries</u></p> <p>Aims at identifying appropriate practices for HCWM by providing assessment and planning tools applicable in most sub-Saharan countries of Africa.</p> |
| | <p><u>WHO: HCWM Expanded Costing Analysis Tool (ECAT) for Low-Income Countries</u></p> <p>Created to help the user estimate costs related to HCWM at the health care facility, central treatment facility or cluster, and national levels.</p> |
| TECHNOLOGY | <p><u>WHO: Overview of Technologies for the Treatment of Infectious and Sharp Waste from Health Care Facilities</u></p> <p>Provides guidance on choosing the appropriate technology for treating health care waste, taking into account technical, financial, and environmental requirements.</p> |
| | <p><u>Healthcare Without Harm: Non-Incineration Medical Waste Treatment Technologies</u></p> <p>Seeks to provide information to aid in evaluating non-incineration technologies and to create a dialogue around the HCWM system.</p> |
| | <p><u>World Bank: Decision Maker's Guides for Solid Waste Management Technologies</u></p> <p>Created to help decision-makers understand available technologies and when they would be appropriate, based on local circumstances.</p> |

SECTION 3



UNDERSTANDING HCWM POLICY AND PRACTICE

POLICY AND LEGISLATION

WHO's [Safe Management of Wastes from Health-Care Activities](#) provides detailed guidance about all aspects of HCWM, including important legislative and policy aspects and fundamental policy principles (see box). "All countries should have a HCWM policy that serves as a blueprint to drive decision-making at a political level and mobilize government efforts and commitment to create the conditions to make changes at the facility level."^v The policy will then guide legislation and supporting regulations for effective HCWM, including role expectations from health care staff.

Fundamental Policy Principles

Five fundamental principles should govern national policy, legislation, and guidance: *Polluter pays* • *Precautionary* • *Duty of care* • *Proximity* • *Prior informed consent* (see the [WHO Blue Book](#) for more details)

RECOMMENDED BEST PRACTICES AND STANDARDS

WHO has established standards for operational level HCWM that are highly regarded and have been largely adopted in most countries at the policy level.^{vi} The basic steps for meeting these standards include the following:

Best practices and standards for HCWM

| TYPE | BEST PRACTICES | APPLICABILITY TO IMMUNISATION |
|---------------------------|--|--|
| 1 MINIMIZATION | Countries should, as much as possible, try to minimize generation of all types of waste: for example, procuring products with less packaging or plastics without PVC. Ensuring proper waste segregation can also minimize the quantity of infectious waste that needs to be treated. | Minimize packaging as much as possible; minimize hazardous waste through segregation; coordinate with manufacturers and suppliers to ensure that production of syringes uses a single type of plastic to improve recycling efficiency. |
| 2 SEGREGATION | The correct segregation of HCW is the responsibility of any health care provider generating each waste item. Each facility should have waste containers using a uniform colour-coding system; it is integral to segregate infectious waste from general waste to reduce the amount of infectious waste. All waste should be clearly labeled with content, date, time of closure, and person responsible. | Use safety boxes for syringes or needle cutters to reduce quantity of waste. Needles should never be re-capped. |

| | | |
|---|---|--|
| <p style="text-align: center;">3 STORAGE</p> | <p>Infectious and sharp waste storage should be separate from general non-hazardous waste, clearly labeled, in a room with sealed or tiled floors and walls to allow easy cleaning. Similar conditions should be in place for other hazardous waste.</p> | <p>Keep used syringes stored safely together with other infectious waste.</p> |
| <p style="text-align: center;">4 COLLECTION</p> | <p>Infectious and sharp waste should be collected within two to four days, depending on climate and storage conditions.</p> | <p>Immunisation waste collected with other waste.</p> |
| <p style="text-align: center;">5 TRANSPORTATION</p> | <p>On-site transportation: infectious waste should be transported in a trolley or a cart that is easy to load and unload, devoid of sharp edges that could damage waste bags or containers, and easy to clean.</p> <p>Off-site transportation: transportation should always be properly documented and all vehicles should carry a consignment note from the point of collection to the treatment facility. Vehicles used for the collection of hazardous/ infectious HCW should not be used for any other purpose. They should be free of sharp edges, easy to load and unload by hand, easy to clean/disinfect, and fully enclosed to prevent any spillage on the hospital premises or on the road during transportation.</p> | <p>Immunisation waste transported with other waste according to best practices and standards.</p> |
| <p style="text-align: center;">6 TREATMENT</p> | <p>Waste should be treated with technologies that minimize the formation and release of chemicals or hazardous emissions. Infectious and sharp waste should be treated by steam (e.g., autoclaving) or other non-burn technologies. Smaller, local incinerators often do not comply with these standards. Sharp waste should be treated in a centralized autoclave facility, shredded, and buried in a landfill.</p> | <p>Safety boxes should be destroyed by incinerator with pollution control</p> <p>Separated needles treated by autoclave</p> <p>Separate plastic syringes treated by autoclave or microwave</p> |
| <p style="text-align: center;">7 FINAL DISPOSAL</p> | <p>Waste should not be disposed on the premises of healthcare facilities. Non-hazardous waste should be collected or transported regularly to well-managed public disposal sites. All hazardous waste should be treated prior to disposal, or should be disposed of in a landfill designed for hazardous waste.</p> | <p>HCWs should incinerate safety boxes, then dispose in ash pit or landfill</p> <p>Needles: recycle or store in lined needle pit</p> <p>Plastic syringe: recycle or shred for landfill</p> |
| <p style="text-align: center;">FACILITY-LEVEL MANAGEMENT</p> | <p>It is recommended to have facility-based management teams to facilitate HCWM and monitor activities.</p> | |

CHARACTERISTICS OF IMMUNISATION WASTE

In immunisation activities specifically, waste is usually generated through sharps (i.e., syringes and needles), used or expired vaccine vials, and cotton swabs from cleaning skin. There is also some general waste generated from packaging and/or any communications and training materials produced for health care workers as part of a

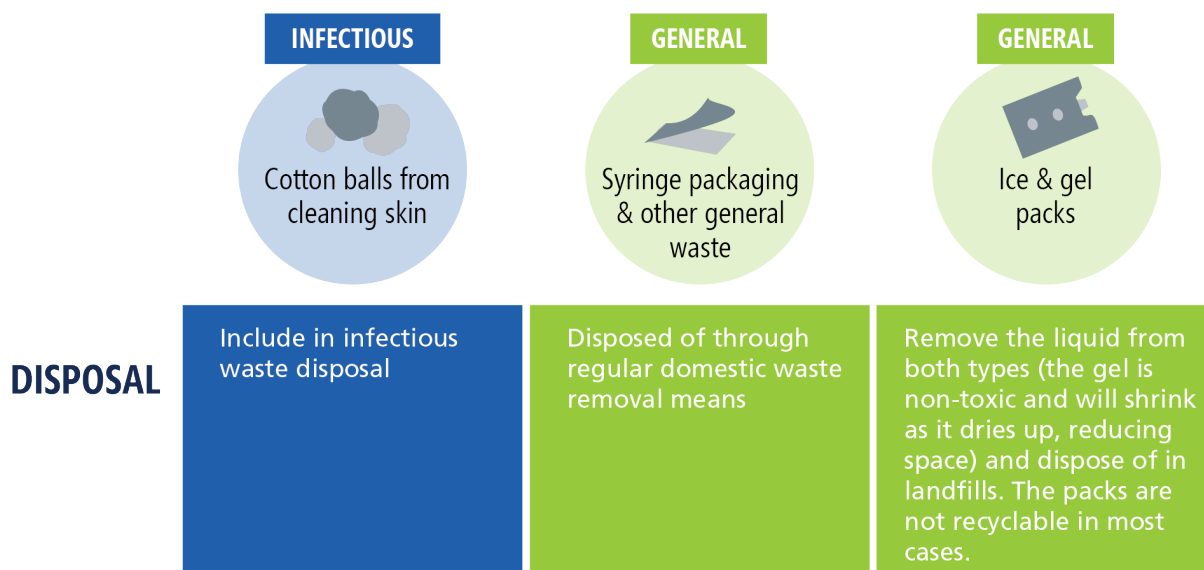
campaign or routine immunisation program. Sharps fall into the highly infectious (i.e., most hazardous) category for health care workers, waste handlers, and the community at large because of the risk of needle-stick injuries, which carry a high potential for infection.

Waste generated by immunisation activities



| | | | | |
|--------------------|--|---|---|--|
| SEGREGATION | Collected in own box | Remove the needle | -or- | Maintain the needle and plastic syringe and dispose of in safety boxes |
| | Waste storage should be separate from general non-hazardous waste, clearly labeled in a room with sealed or tiled floors and walls to allow for easy cleaning. | | | |
| STORAGE | Infectious and sharp waste should be collected within two to four days, depending on climate and storage conditions | | | |
| COLLECTION | <p>On-site transportation: Should be transported in a trolley which is easy to clean and has no sharp edges</p> <p>Off-site transportation: Clear documentation, vehicle used only for infectious waste, easy to clean, and fully enclosed</p> | | | |
| TRANSPORT | Autoclave -or- Chlorine -or- Boiling | Separated Needle: Autoclave Plastic Syringe: Microwave -or- Autoclave | | |
| TREATMENT | Recycle -or- Crushed & placed in a pit in a contained way | Needle: Recycle -or- Lined needle pit | Plastic Syringe: Recycle -or- Shred for landfill | Maintained needle and syringe: High temperature incinerator with pollution control Dispose: Ash pit -or- Landfill |
| DISPOSAL | | | | |

Other types of waste unique to an immunisation program



Note 1: In the case where suppliers can take back unused or expired vaccines, this is both the preferred and safest option.

Note 2: Additional guidance on cold chain equipment is provided by UNICEF's guidance on [Decommissioning and Safe Disposal of Cold Chain Equipment](#).

CHALLENGES

Despite available guidance and policies, practice and adherence to the guidance can be inadequate in different countries and at different levels of the health system. This is particularly true at the health facility level, where the majority of waste is generated. Although the reality is different in each country, common barriers and challenges to practicing effective HCWM, summarized below, consistently come up across the literature and in practice.^{vii, viii, ix}

Financial resources

Countries often lack the resources, both financial and technical, for acquiring and operating the best available techniques and technologies, including personal protective equipment. Additionally, the "polluter pays" principle mandates that the waste generator meet waste management costs. Thus, immunisation programs have the responsibility of meeting immunisation waste management costs by including these costs in plans and budgets.

Potential solutions: implement an operational level assessment for improved planning and budgeting of needs for waste management and disposal (for routine and campaigns); include WM in larger projects for resource mobilization for domestic investment as well as external donors and partners.

Change management

Even if national level policies and guidelines have been updated to reflect BAT and BEP, changing practices at the waste generation point is often still required. Lack of adherence to guidance can lead to lack of proper segregation, unsafe handling of waste, and dumping of untreated waste. The outdated approach of burning HCW in pits at facilities or using small incinerators has yet to be decommissioned in many places. Additionally, the diverse natures of materials found in the waste (most of which are not biodegradable) are likely to be contaminated with infectious and chemical agents if not segregated and treated properly.

Potential solutions: revise policies and

guidance; provide integrated supervision and capacity building in waste management; refresh knowledge on HCWM practices; ensure tools such as colour-coded segregation bags are available; establish a system of peer-to-peer learning to combat turnover at the facility level to ensure continued adherence to HCWM best practices.

Health care workers' knowledge

Many health care workers and waste handlers have limited awareness or knowledge of both the public health and environmental impacts associated with pollution and the link to toxic contaminants released by burning HCW. Health care workers, waste handlers, and managers frequently receive insufficient or inadequate training on HCWM during pre-service or in-service training.

Potential solutions: consider including HCWM as a refresher topic into other immunisation-related trainings, supervision, on-job learning, and/or review meetings; peer-to-peer learning strategies to reinforce best practices.

Technologies

The technology and equipment for HCWM is often out of date, and the infrastructure required for supporting best practices is insufficient. Incinerators with pollution control that reaches over 1000°C are the current recommended technology for sharps waste management. Non-burn technologies for sharps specifically (i.e., autoclave or microwaving plus shredding) are a potential solution, yet the technology for effective shredding is not widely available.

Potential solutions: conduct inventory of existing treatment technologies and equipment; identify gaps and needs to find collective solutions until and as new technology becomes available to reach BAT standards.

Without a strong, effective HCWM system, anyone in contact with HCW can be exposed to risks: the health care worker providing immunisations, clients at facilities, support service personnel, transport and treatment personnel, or even informal recyclers scavenging landfill sites. Risks include physical injury through sharps and potential infections. Hazards can also exist in treatment facilities where HCW is burnt through incinerators that have no pollution control device, thus releasing particulates, dioxins, furans, and heavy metals into the

Supportive supervision and monitoring

HCWM is often not a priority during integrated supportive supervision visits. As a result, compliance with regulations and guidelines, particularly with the fundamental practice of waste segregation, remains a problem.

Potential solutions: integrate HCWM into supportive supervision checklists and plans as well as on-site visits or periodic spot checks (i.e., availability and proper use of safety boxes for syringes, bags and equipment for all waste; adhering to best disposal practices); reinforce best practices through peer-to-peer networks.

Sharps management during vaccine campaigns

Vaccine campaigns present a unique challenge, since they generate considerable sharps waste in a short period of time.

Potential solutions: refer to [WHO's guidance on planning a campaign](#) to ensure adherence to best practices; coordinate with the WM sector for advanced proper planning of campaign activities and build in WM as part of post-campaign monitoring.

Systematic approach

HCW is generated by all health programs and must be coordinated and planned for across multiple sectors. Lack of coordination can lead to gaps in treatment technology and equipment in certain geographic areas or underutilized resources.

Potential solutions: use the maturity model to engage a broad group of stakeholders; use planning tools to cluster facilities and identify available equipment for optimal use; coordinate across WM stakeholders.

environment. All of these substances are linked to grave health concerns such as respiratory infections and cancer.

These challenges can be addressed and risks mitigated through proper HCWM, including good maintenance of equipment, use of incinerators with pollution control, and adherence to best practices at the point of waste generation. The [WHO Blue Book](#) provides many more details of risks and mitigation strategies.^x This guide also highlights some innovations from the field, such as private sector engagement in Ghana and integrated management and supervision in Kenya.



INNOVATIONS FROM THE FIELD: Private-Sector Engagement in Ghana as a Best Practice for HCWM

The Government of Ghana set up a public private partnership in 2015 to establish ZoomPak, a state-of-the-art, centralized HCW treatment system, to address the tons of hazardous and sharps waste generated in the densely populated capital of Accra. The treatment centre consists of a reception area, a refrigerated temporary storage unit, a large autoclave decontaminating waste, and a shredding system to render treated waste unrecognizable and reduce its volume. Initially, the treatment facility was underutilized. With support from UNDP/GEF, a partnership was established between the Ghana Health Service and ZoomPak Ghana Limited to provide best-practice HCWM services to health facilities in the Greater Accra region, resulting in better utilization of the treatment services. Over two years, the amount of waste treated in an environmentally friendly manner increased from about 0.3 tons per month to nearly 10 tons by the end of 2018. This increase has placed the business on much sturdier financial ground. Likewise, this initiative contributed significantly to improving HCWM by introducing best practices and reinforcing policies established by the Ministry of Health. Similar actions have been taken in Uganda.

<https://www.ghanaweb.com/GhanaHomePage/business/Zoompak-inaugurates-new-Achimota-Transfer-Station-539362>

SECTION 4



STRATEGIC ASSESSMENT OF YOUR HCWM SYSTEM: USING THE MATURITY MODEL TO DETERMINE FIRST STEPS OF INVESTMENT

DEFINING YOUR HCWM SYSTEM

HCWM must be considered from a systems perspective and use a broad approach to leverage resources, technologies, and capacity across ministries and government entities involved in WM. A successful systems approach includes a holistic range of activities to develop best practice, including waste minimization strategies, key performance indicators, staff training and awareness, and appropriate technology and equipment.^{xi} Such an approach must consider the three main areas of a HCWM system– **people, processes, and technology**.



Identify your **PEOPLE** (and expected core competencies of cadre of staff) and human resources needed to train staff and build awareness of the importance of HCWM; increase adherence to and understanding of policies and guidelines; and show commitment to high-quality HCWM.



Identify what **PROCESSES** need to be revised or updated, such as national policies, budget, guidance; map out the flow of HCW between clusters of facilities and to treatment and disposal sites; assess the effectiveness of supervision.



Identify the **TECHNOLOGIES** that are available currently for the steps of HCWM, including segregation, potential links to private-sector resources; and clarify the priorities for the HCWM system overall.

Therefore, this system requires more complex solutions than simply purchasing a new incinerator or other piece of equipment. Effective HCWM entails careful planning to ensure that all health workers and waste handlers:

- » **Understand and adhere** to waste management guidelines
- » **Receive the required** resources and tools, such as colour-coded segregation bags
- » **Have processes defined** for treatment and disposal of waste
- » **Have access** to the best available technologies to complement the best environmental practices
- » **Are fully protected** against risks associated with unsafe waste management, both through immunisation and occupational safety measures such as personal protective equipment.

USING THE HCWM MATURITY MODEL

It is important to categorize HCWM systems to identify successes, best practices, gaps, and opportunities across the many facets of HCWM. This section features use of the maturity model to facilitate this process.

The HCWM maturity model is not a full-scale assessment; it is meant to initiate discussion and a high-level review. As a strategic-level assessment tool, the maturity model is the first step in both **engaging stakeholders** from across the health system, and **identifying the current effectiveness** of HCWM in the country. The model examines six key areas in HCWM in terms of five levels of effectiveness. The assumption is that the HCWM system will pass through the levels in the model's sequence as it becomes more effective. This tool can serve as a benchmark to gauge improvements over time and identify priority areas for investment. It is **not** an in-depth operational assessment.

This maturity model is designed for HCWM across all programs and areas, but it is applicable specifically for immunisation waste, both for routine and supplemental immunisation activities (SIA). The model should be used to stimulate meetings and dialogue among stakeholder groups, program managers, and budgeters to help make connections across programs and ensure a collaborative approach to the HCWM system.

Guidance for use

Complete the analysis of the maturity model, using perspectives on the country context from discussions with HCWM stakeholders, to identify where the country lands on this continuum of maturity. The model describes six key areas that are important for HCWM, ranking from Level 1 (lowest level) to Level 5 (highest level).

Sources of information




Insight can be gleaned from recent assessments, reports, guidelines, strategies, policies, inventories for technology and equipment, and/or practical experience and knowledge from a variety of HCWM sources. Review training records, audit and supervision reports, and any observation or interview with health care workers. This tool can be used at the national level or even at regional level to tailor practical application for HCWM.

Who should be involved

Stakeholders who have a realistic understanding of the HCWM system are integral to discussions. From the immunisation program, this could be national and sub-national level managers or officers, and supply-chain decision-makers. It is also critical to get the facility-level perspective, either through the in-charge or the health care worker providing immunisations. Beyond immunisation, it is prudent to include the government entity responsible for HCWM as well as the broader waste management department and officials through the Ministry of Environment and Ministry of Finances as well as partners that can work with the government. See [Annex 3](#) for an exhaustive list.




Stakeholders should jointly examine the country's status in terms of six key areas.

Six key areas for assessing the maturity of HCWM systems

| | |
|---|---|
|  <p>PEOPLE</p> | <ol style="list-style-type: none"> 1. Awareness, training and supportive supervision: Looks at the availability of training for health care workers and waste handlers on HCWM (both pre-service and in-service) and the level of integrated supervision that incorporates HCWM such as monitoring the availability and proper use of safety boxes for syringes; and tracks comprehension of best practices in HCWM. 2. Adherence and compliance: Assesses the level of adherence to best HCWM practices across the entire process, from point of generation to point of disposal. Monitoring and evaluation frameworks and key performance indicators in place and supported through supervision. |
|  <p>PROCESSES</p> | <ol style="list-style-type: none"> 3. National policy/strategic plans: Includes national policies and strategic plans for HCWM (including any immunisation specific policies or guidance); laws and regulations related to HCWM; and environmental impacts and policies on environmental sanitation and hygiene – to list a few. 4. Budget and planning: Reflects the country having developed an appropriate budget that is fully funded and supports realistic needs. Budgets should be linked to resources and tools needed across all steps of HCWM, such as colour-coded bags at the facility level, transport for waste, treatment and disposal sites, and maintenance for HCWM equipment. 5. Practical guidance: Looks at the hands-on tools such as standard operating procedures (SOPs), communication guidance, and job aids for health care workers and waste handlers directly involved in generating and managing waste. |
|  <p>TECHNOLOGY</p> | <ol style="list-style-type: none"> 6. Technology and equipment availability and use: Beyond equipment for treatment and disposal, this key area also incorporates all of the tools and supplies needed for HCWM. This begins with colour-coded collection technology at point of generation of waste, resources for occupational health and safety such as personal protective equipment, through the entire management process until disposal. This area should also consider maintenance for equipment to ensure functionality and overall sustainability. |

Through discussion with key stakeholders, identify the level (1–5) that best represents the country's current state of policy and practice for HCWM across those six areas, referring to the maturity model in [Annex 2](#). This scoring process is the beginning of a process that stakeholders will repeat at intervals as the system reaches maturity. A full operational-level assessment occurs as a later step (tools and resources are widely available to guide that process) and should be planned for in a proposal if not recently completed.

Maturity Model

| | AREA | LEVEL 1 | LEVEL 2 | LEVEL 3 | LEVEL 4 | LEVEL 5 |
|--|---|---|--|---|--|--|
| PEOPLE  | Awareness, training and supportive supervision | Low level of awareness of risk associated with HCW (less than 40%) | Moderate awareness of risk associated with HCW; curriculum developed but not fully rolled out (implemented in 41%–50% of facilities) | A significant proportion of health workers and waste handlers (51%–75%) are trained on the risks associated with HCW and clear guidance on HCWM is available at most facilities | High level of awareness of HCW risk. 76%–85% health care workers and waste handlers have undergone training and have access to on-going training | More than 85% of health workers and waste handlers are trained and are aware of risks associated with HCW and demonstrate BEP. HCWM is included in supportive supervision activities |
| | Adherence and compliance | Little insight into adherence of best practices for HCWM | Have insight and best practice of HCWM available (SOPs and job aids) but not practiced (less than 50% of facilities adhere and comply) | Best practices of HCWM being adhered to in at least half of the facilities; minimal M&E in place | Significant compliance to the best HCWM practices. M&E framework in place with some tracking of adherence | Country fully adheres to the best practices; M&E framework tracks adherence to policies and guidance |
| PROCESSES  | National policy/ strategic plans | Policy is needed or currently being developed. No recent HCWM assessment carried out (within the last 5 years) | Policy developed and/or reviewed within the last 5 years. HCWM assessment carried out within the last 5 years | Policies and guidelines are disseminated and partially adopted | Country can show that the policies and guidelines are fully implemented at all levels of the system | Policies widely adopted across the country. Evidence that WM performance gaps are addressed in strategic planning and financing mechanisms at national and sub-national levels. |
| | Budget and planning | HCWM is not planned and budgeted | Budgeted but not directly linked to realistic needs or assessment findings | At least half of facilities develop a HCWM budget and implement specific plans | Budgets are available, funded and tracked at 75% of system levels | HCWM is 100% budgeted at national and sub-national levels |
| | Practical guidance | Need, or currently being developed | Guidance developed but not fully in use (used in less than 50% of the facilities) | Guidance is developed and in use in 50%–65% of the facilities within the country | Guidance is available and being implemented at most (65%–85%) system levels | Guidance is available and in use at more than 85% of facilities within the country |
| TECHNOLOGY  | Technology and equipment availability and use | Not aware of BAT and BEP. Out-of-date, inefficient, non-environmentally friendly options for treatment and disposal | Awareness of the recommended BAT and BEP options but still using out-of-date equipment and technology | Some BAT equipment available at 50% of facilities (or 50% accessing services) and/or at least 50% of the waste being generated is treated and disposed using globally accepted technologies | Globally accepted equipment is widely (more than 51%) available; most facilities are clustered and mapped to an acceptable treatment technology | Only efficient and BAT used to manage HCW. Environmental monitoring of waste treatment and disposal done in compliance with national and/or global standards |

Ranking the maturity model

With stakeholders, examine each key area and decide what level best represents where the country or region is in terms of HCWM. Note the scores in the first table in the Assessment Tool (Table 1; also seen [Annex 1](#)) to summarize responses.

Through further discussion, once you have completed the maturity model, use the level above your country's current score as a goal to prioritize investments and strategic actions. The maturity model acts as a guide to help prioritize and structure your HCWM improvement process. **The true outcome of a maturity model assessment is not to identify what level your system resides on, but rather to draft a preliminary list of realistic steps that you can then implement to improve your current HCWM system.**^{xii}

Findings from the maturity model can be considered within the overall context of the maturity of the immunisation supply chain and how waste management complements key insights from Effective Vaccine Management (EVM) assessments, implementation of the EVM improvement plan, and progress on the five supply chain strategy fundamentals.¹

Table 1: Your country's rank for people, processes, and technologies in HCWM

| | AREA | LEVEL RANKING (Level 1–5, lowest to highest) |
|------------|--|---|
| PEOPLE | Awareness, training and supportive supervision | |
| | Adherence and compliance | |
| PROCESSES | National policy/ strategic plans | |
| | Budget and planning | |
| | Practical guidance | |
| TECHNOLOGY | Technology and equipment availability and use | |
| | TOTAL | |
| | Divide by 6 (number of areas) | /6 |
| | OVERALL SCORE | |

¹ More information can be found here: <http://www.gavi.org/support/hss/immunisation-supply-chain/>



IDENTIFY OPERATIONAL LEVEL GAPS, OPPORTUNITIES, AND SCALABLE INNOVATIONS WITHIN THE HCW SYSTEM

Now that you have identified where your HCWM system falls on the maturity model, this section helps you identify high-level gaps and opportunities in your system. Gaps are defined as the discrepancy between where the country desires to be and where it is currently in all aspects of HCWM: human resource, commodity security, information systems, technology, levels of knowledge and skills among staff, management support, leadership, adherence to best practices in managing health care waste, partner engagement, etc. To **identify the gaps** in your system, use the ranking of the HCWM maturity model and what you know about HCWM in your country as your starting point, according to the level of practice you are planning for. Be able to describe what areas need the most attention, applying what is known from your own context. Use the Assessment Tool in [Annex 1](#) to identify high-level gaps in the three areas of people, processes, and technology, and potential opportunities for investment.

Common Barriers and Challenges to HCWM



- » Constrained financial resources
- » Complicated change management with new equipment, practices and technology
- » Limited awareness or knowledge on best practices and HCW risk
- » Obsolete technologies, equipment or practices
- » Supportive supervision lacking HCWM
- » Sharps management during campaigns
- » Missing links to a systemic approach across all sectors for HCWM



INNOVATIONS FROM THE FIELD: Innovations in the HCWM System in Kyrgyzstan Make Significant Advances

Introduced in 2006, the HCWM model in Kyrgyzstan brought cost savings, generated revenues from recycled materials, documented improvements in occupational safety, and gained as wide acceptance and commitment from health care workers. The system included many innovative aspects (see the links

below for details). Impressive highlights include mechanical needle removers used immediately after injection; after treatment with an autoclave, both the needles and plastic syringes are sold to recycling firms. Infectious waste is segregated using buckets with double enamel coating, reducing the need for bags. In addition to becoming a sustained system without other financial and technical support, the new system greatly reduced the volume of toxins released during treatment and disposal of HCW, improving environmental impacts. There is also room for improvement, as immunisation waste is still only marginally integrated into the overall system.

<https://www.redcross.ch/de/file/15025/download>; Toktobaev et al., "An Innovative National Healthcare Waste Management System in Kyrgyzstan," <https://doi.org/10.1177/0734242X14565209>.

Besides the available tools highlighted at the beginning of this document, below are a few additional guidance documents, planning tools, and innovative ideas that were implemented successfully by various countries. They are generally organized into the people-processes-technologies categories, yet there is often overlap across the three areas. These innovations may not all be appropriate or available for your country's context. However, technology, equipment, and techniques are always changing—which brings opportunities to upgrade and adapt HCWM approaches to reduce environmental impact and health risks and introduce cost savings.

THESE TOOLS CAN HELP YOU IMPLEMENT AN OPERATIONAL LEVEL ASSESSMENT AND DEVELOP AN OPERATIONAL PLAN



WHO HCWM RAPID ASSESSMENT TOOL (RAT)

This rapid assessment tool is a part of an overall strategy developed by WHO and aimed at reducing the disease burden caused by poor healthcare waste management (HCWM) through the promotion of best practices and the development of safety standards.

https://www.who.int/water_sanitation_health/facilities/waste/hcwmtool/en



UNDP INDIVIDUALIZED RAPID ASSESSMENT TOOL (I-RAT)

Adapted from WHO's RAT, which evaluates the HCWM situation on a national level, the UNDP GEF Project's I-RAT is intended for use at the individual healthcare facility level. http://www.undp.org.lb/announcement/Application_form.xls



GLOBAL FUND NATIONAL CAPACITY PLANNING TOOL

Use this tool to assist in creating awareness of best practices and identifying gaps for national waste management capacity. It is for completion by politicians, committees, and organizations for making decisions on how healthcare waste management can be developed and best practices implemented for their location. www.theglobalfund.org









UNICEF PLATFORM TO JOINTLY DESIGN AND IMPLEMENT A SOUND IMMUNIZATION WASTE MANAGEMENT SYSTEM







[This tool](#) assists decision makers to cluster facilities around treatment and disposal equipment and sites, estimate technology and budgetary needs based on waste generated, and identify sites for equipment location for HCWM of the immunization program. www.UNICEF.org

Moving your country's HCWM program ahead



Advances in technology, and the growing global interest in waste management and its environmental impact, have created many opportunities to help your country reach its HCWM goals. In each of the six areas of the maturity model, identify the opportunities based on current strengths to leverage and build upon. For example, identify the current champion for HCWM, and what is needed to raise the profile of waste management through that champion. The information below describes some of the tools, guidance, and innovative approaches available to advance your country's HCWM, including HCWM for immunisation, in terms of people, processes, and technology.

WHAT ARE THE OPPORTUNITIES, TOOLS, AND INNOVATIONS FOR THE PEOPLE PART OF THE HCWM SYSTEM?

| | | |
|--|---|---|
| ADVOCACY AND RESOURCES At the national level, build country leadership and ownership through advocating for more resourcing for HCWM |  Tools | <ul style="list-style-type: none"> » UNICEF's Advocacy Toolkit » Evidence on importance of HCWM in reducing costs, health risks, and negative environmental impact. Check out the "Health Care Waste Management" Topic page on TechNet-21 |
| |  Innovations | <ul style="list-style-type: none"> » Kyrgyzstan revised their entire HCWM system through improved policy, practices, and monitoring, with impressive results |
| CAPACITY BUILDING Increase capacity, knowledge, and adherence to best practices at the facility level |  Tools | <ul style="list-style-type: none"> » MLM Training, Module 9: Immunisation Safety » Incinerator operations manuals » WHO Blue Book » UNEP/WHO: Preparation of National HCWM Plans |
| |  Innovations | <ul style="list-style-type: none"> » In Brazil, strictly tracking waste quantities improved segregation and reduced costs, providing evidence and incentive for increased funding. » Include HCWM into pre-and in-service training curricula |
| HCWM FACILITY TEAM Strengthen management through HCW team at the facility level |  Tools | <ul style="list-style-type: none"> » Health Care Without Harm provides guidance on establishing HCWM facility-level committees » Adapt existing quality improvement tools for HCWM |
| |  Innovations | <ul style="list-style-type: none"> » Kenya established Health Facility Committees to engage the broader community in governance issues; this could be used as a model to also incorporate WM |


| | | |
|---|---|--|
| SUPPORTIVE SUPERVISION Incorporate waste management into regular supportive supervision |  Tools | <ul style="list-style-type: none"> » MLM Training, Module 9: Immunisation Safety » UNDP/GEF: HCWM Planning in a Healthcare Facility » Scoreboard Industry Standards: KPIs for HCWM |
| |  Innovations | <ul style="list-style-type: none"> » Incorporate WM into other existing supervision checklists (sample KPIs: availability and proper use of safety boxes for syringes; bags and other equipment for all waste; adherence to best disposal practices; percentage of hazardous waste disposed off-site) » Integrate other supervision tools with HCWM » Track quantity of waste as an indicator to improve waste segregation, as demonstrated in Brazil |
| PLANNING Ensure tools and supplies are consistently available to guarantee that health care workers can do their job safely and effectively |  Tools | <ul style="list-style-type: none"> » Planning tools (UNICEF Platform to Jointly Design and Implement a Sounds Immunization WM System; Global Fund National Capacity Planning Tool; Health Care Without Harm) » WHO's Field Guide for SIAs; can assist with planning for needed supplies for routine immunization as well |
| |  Innovations | <ul style="list-style-type: none"> » Kyrgyzstan uses colour-coded buckets with double enamel coating for segregating infectious waste, reducing the need for bags |
| EQUIPMENT MAINTENANCE Create a pool of highly technical equipment teams for maintenance |  Tools | <ul style="list-style-type: none"> » WHO has developed guidance for organizing the maintenance of healthcare technology and a team of trained technicians » User manuals of equipment » Build expert technical maintenance teams |
| |  Innovations | <ul style="list-style-type: none"> » Bundling service through the manufacturer or private sector provider may introduce cost savings and economies of scale » A new incinerator installed in Nigeria was bundled with maintenance provided by the manufacturer |

WHAT ARE THE OPPORTUNITIES, TOOLS, AND INNOVATIONS FOR THE PROCESSES PART OF THE HCWM SYSTEM?

| | | |
|--|---|--|
| NATIONAL LEVEL WORKING GROUP At national level, establish functional HCWM working group through which change can be affected |  Tools | <ul style="list-style-type: none"> » The same principles laid out to establish a national logistics working group can be applied for a HCWM working group |
| |  Innovations | <ul style="list-style-type: none"> » Many countries in the Western Pacific Region have had success establishing National Committees on HCWM |

| | | |
|--|---|--|
| POLICIES & STRATEGIC PLANS At the national level, update and revise national policies and strategic plans to reflect BAT and BEP |  Tools | <ul style="list-style-type: none"> » Kenya's HCWM Strategic Plan » Read about key points to include in policies here |
| |  Innovations | <ul style="list-style-type: none"> » Nigeria showed that safe HCWM can be implemented if the government leads by providing policy and required resources |
| OPERATIONAL LEVEL ASSESSMENT Conduct an operational level assessment to develop operational plan |  Tools | <ul style="list-style-type: none"> » UNICEF Platform to Jointly Design and Implement a Sound Immunization Waste Management System » Health Care Without Harm Guidance for HCWM Plan » WHO: HCWM Rapid Assessment Tool (RAT) » UNDP: Individualized Rapid Assessment Tool (I-RAT) » Service Availability and Readiness Tool (SARA) |
| |  Innovations | <ul style="list-style-type: none"> » Ghana strategically mapped out health facilities to a large private-sector treatment plant, making a more effective approach overall |
| BUDGETING Develop appropriate budget based on realistic needs and operational plan |  Tools | <ul style="list-style-type: none"> » WHO ECAT for budgeting » Healthcare Without Harm Guidance for budgeting » WHO guidance on budgeting for HCWM » Country budgeting tools and papers |
| |  Innovations | <ul style="list-style-type: none"> » Brazil's experience using waste quantity as an indicator led to improved budgeting and reduced costs |
| COLLABORATION, PRIVATE SECTOR & GLOBAL FINANCING Explore innovative ventures and collaboration with both public and private partnerships, across government entities and WM industry, potentially with global financing streams, as well as north-south collaborations |  Tools | <ul style="list-style-type: none"> » Private Sector Engagement Guidance » Private Sector Engagement Toolkit » Explore collaborative approaches with the Global Environment Facility » Extended manufacturer responsibility » Generate system strengthening funds |
| |  Innovations | <ul style="list-style-type: none"> » Ghana ZoomPak private-sector engagement increased availability of WM treatment and disposal » Swaziland developed an HCW certification system of transporters to license transport companies » Integrate WM into contracts: Sustainability Roadmaps for Hospitals » Global projects are often willing to pilot introduction of BATs in developing countries to focus on reducing environmental impact |
| STANDARD OPERATING PROCEDURES Update standard operating procedures to clarify procedures that match highest level expectations of HCWM |  Tools | <ul style="list-style-type: none"> » Kenya Standard Operating Procedures example |
| |  Innovations | <ul style="list-style-type: none"> » Clarifying standard operating procedures has shown to improve segregation of waste, a fundamental factor of successful HCWM |

WHAT ARE THE OPPORTUNITIES, TOOLS, AND INNOVATIONS FOR THE TECHNOLOGY PART OF THE HCWM SYSTEM?

| | | |
|---|---|--|
| EQUIPMENT INVENTORY Conduct an inventory of HCWM equipment and technology available in the country, both in public and private sectors |  Tools | <ul style="list-style-type: none"> » UNICEF Platform to Jointly Design and Implement a Sound Immunization Waste Management System » WHO: HCWM Rapid Assessment Tool (RAT) |
| |  Innovations | <ul style="list-style-type: none"> » Consider installing an inventory management system across the health system for all equipment |
| EQUIPMENT NEEDS PLANNING Based on results of assessment, plan for optimized use of technology, equipment and long-term investment opportunities |  Tools | <ul style="list-style-type: none"> » WHO: Overview of technologies for the treatment of infectious and sharp waste from health care facilities » Health Care Without Harm: Non-Incineration Medical Waste Treatment Technologies » World Bank: Decision Maker's Guides for Solid Waste Management Technologies » UNEP's Compendium of Technologies for Treatment/ Destruction of Healthcare Waste |
| |  Innovations | <ul style="list-style-type: none"> » Waste sorting technologies: water-based technologies, removing waste by magnet, eddy current, infrared, targeted air jets. Research Beston waste sorting machines » Needle cutters as innovation to "de-fang" syringes. Technology around needle cutters and melters has improved, enabling isolation of potentially infectious sharps. Read about PATH's experience in Myanmar |
| PRIVATE SECTOR ENGAGEMENT Explore links with private sector partners to leverage resources and explore creative recycle options |  Tools | <ul style="list-style-type: none"> » Private Sector Engagement Guidance » Private Sector Engagement Toolkit |
| |  Innovations | <ul style="list-style-type: none"> » Plastic from medical waste is being recycled into asphalt to build roads (research Technisoil Industrial) or plastic lumber (review Triumvirate) » Glass can be recycled to make Glassphalt, the environmentally friendly, cost-effective pothole fix; not all vaccine vials would be appropriate for this. See more from the South African company Indlovu Sebenza » Landfill modernization in the Philippines reduces harmful methane emissions through a partnership with whirring, whizzing, and sorting machines; a World Bank project » Converting syringes into construction material, taking treated and shredded sharps and creating pellets. Research PELLA DRX for more information » Robotic waste pickers and sorters according to type of plastic to allow for recycling of materials. See CleanRobotics' TrashBot » Plasma gasification may be the next generation of waste management technologies to explore |



INNOVATIONS FROM THE FIELD: An Integrated Approach to Waste Management in Kenya

[UNDP's project](#) in Kenya uses an integrated approach aimed at increasing the proper management of waste within hospital facilities (increasing segregation, reducing waste generation) and by replacing the dangerous disposal waste modalities such as open burning or burning in single chamber incinerators. Besides training at the facility level, the project also focused on the municipal waste side by reinforcing the Reduce, Reuse, Recycle economy on two specific waste streams: 1) by enhancing their upstream collection, ensuring the quality of recovered material, and 2) securing access to the national market by promoting cooperation with domestic industries.



DESIGNING AND IMPLEMENTING THE HCWM SYSTEM

Designing the most effective system greatly depends on the country context, current maturity level, quantity of waste generated, and resources, among many other things.

Regardless of your country's level on the maturity model, changes and improvements to the HCWM system must be made within the financial and technical system of your country's context.

Improvements can include small, incremental improvements as well as longer-term planning for more significant capital investments, or private-sector engagement in order to obtain optimal options (which may require certain conditions to be met over a longer period of time). It is important to note that the first step of good HCWM practices is segregation of waste at the point of generation, which largely depends on health care worker knowledge and adherence to best practices. Consider reinforcing this aspect through training, supportive supervision, and including key performance indicators into supervision checklists as a priority for your funding proposal.

Below is a list of illustrative indicators that can be used to monitor HCWM at different levels of the system. As part of an overall HCWM plan, stakeholders should identify indicators that are appropriate for the country. This list includes essential indicators (indicated with an asterisk*) that provide insights into the functionality and progress of the HCWM system. The remaining indicators are desirable indicators that will supplement essential indicators to understand the system in more depth.

Countries are encouraged to develop HCWM interventions that support or provide a **catalyst for a systems approach**. This may include implementing measures that address a single component of the system or those that address many components of the system.

ILLUSTRATIVE HCWM INDICATORS

OVERALL WM PROGRAM

- » Proportion of facilities with HCWM guidelines and job aids on display during a particular time
- » Amount of waste generated (kilogram or volume) per square meter /catchment population/facility during a particular time*
- » Amount of waste generated (kilogram or volume) by waste category (non-hazardous, hazardous, infectious, chemical radioactive) per square meter/catchment population/facility during a particular time*
- » Percentage of waste properly segregated into waste categories at source during a particular time*

- » Percentage of the overall number of health facilities in an area maintaining proper levels of waste management coloured bins, bags and other equipment during a particular time
- » Percentage of waste disposed of in a designated landfill during a particular time
- » Proportion of the overall number of waste treatment and disposal technology (i.e., incinerators, autoclaves) in a particular area are functional during a particular time*
- » Proportion of the overall number of waste treatment and disposal technology that meets BAT and BEP criteria*
- » Average cost per metric ton (\$/metric ton) for waste treatment and disposal in a particular area during a particular time*
- » Availability of national health care waste management committee that meets regularly*

SUPPORTIVE SUPERVISION FOR IMMUNIZATION PROGRAMS

- » Percentage of availability and use of safety boxes for syringes during an immunization session*
- » Percentage of availability and use of other colour-coded bins, containers, and equipment for other waste during an immunization session*
- » Percentage of healthcare workers adhering to occupational safety standards with PPE during an immunization session*
- » Percentage of waste properly segregated into waste categories during a particular time*

FACILITY LEVEL

- » Availability of HCWM guidelines and job aids on display where waste is generated during a particular time*
- » Amount of waste generated (kilogram or volume) during a particular time*
- » Amount of waste generated (kilogram or volume) by waste category (non-hazardous, hazardous, infectious, chemical radioactive) during a particular time*
- » Percentage of days during a particular time with full availability of proper waste segregation tools (coloured bins, bags, equipment)
- » Percentage of waste properly segregated into proper colour-coded waste bins in all areas where waste is generated during a particular time*
- » Percentage of waste appropriately labelled and stored during a particular time
- » Percentage of hazardous waste disposed of properly off-site during a particular time
- » Availability and use of acceptable (BAT and BEP) waste treatment technologies for the different categories of waste*
- » Average cost per kilogram for waste treatment and disposal during a particular time*

For proposals

This guide recommends key aspects as part of your preparation for a proposal and planning for sustainable health care waste management interventions:

- » **Conduct a high level** strategic assessment using the HCWM maturity model to identify key gaps and challenges in the current HCWM system, considering the people, processes and technology involved in HCWM. Use the Assessment Tool in [Annex 1](#) and the maturity model in [Annex 2](#).

- » **In your proposal**, plan for immediate actions to address many of the common barriers, for example: implement an operational level assessment (if not recently completed); reinforce health care worker knowledge and behaviour through integrated training and supervision; upgrade and expand treatment technologies where necessary; conduct an inventory of existing treatment equipment and technologies and their utilization.
- » **Identify and engage key stakeholders** from different ministries, government entities, and private sector for WM system planning.
- » **Consider the preferred technology and equipment** for waste management and integration of key principles in sustainable waste management to fill the gaps in the current system while optimizing the utilization of treatment technologies.
- » **As a step in implementing all WM activities**, identify opportunities for other forms of investment and collaboration across sectors.

The detailed steps of choosing and procuring specific technology and equipment once a project is approved should be planned in collaboration with the broader government entity responsible for WM to leverage resources and expertise. A variety of waste treatment technologies are available, and there is not one which is optimal for every need. Factors to consider when selecting waste treatment technology can be grouped into two categories:

NON-TECHNICAL FACTORS:

stage of development of the country's waste management policy and system; ability to comply with environmental regulations; the licensing situation; available human resources and personnel competence; costs and resources; geographical and geological conditions; and opportunity for cooperation among facilities.

TECHNICAL FACTORS:

waste characteristics; scale of technology applied; maturity and robustness of the technology; field of technology applied; treated product characteristics; anticipated future needs; facilities' complexity and ease of maintenance; volume reduction; secondary waste compatibility with existing processes; state of research and development; safeguards and safety; and potential for intrusion—among others. Some of these factors—such as waste characteristics—are better assessed at health facility level.

You will find additional information on specific technologies in [Annex 4](#), as well as detailed steps for selecting waste treatment technology ([Annex 5](#)) to use once a project is funded.

As your country progresses and focuses more attention on operationalizing HCWM best practices through investments or other projects/initiatives, annually re-visit and update your ranking on the maturity model to benchmark changes and improvements. This tool can become a cornerstone of monitoring best practices and innovations.

CONCLUSION

HCWM is a system that must be planned and coordinated across multiple stakeholders and programs. Immunisation leaders must coordinate closely with the government entities responsible for waste management to best link resources and technologies and ensure implementation of best practices for managing health care waste. This guide was designed to help you to prepare and plan your HCWM system. Your system should be based on real needs and a vision of the future for growth, innovations, and opportunities for improvements across all areas of the system.

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Additional resources:

The [Basel Convention](#) on the Control of Trans-Boundary Movements of Hazardous Wastes and their Disposal aims to protect human health and the environment against the adverse effects from the generation, management, transboundary movement, and disposal of hazardous and other wastes.

The [Stockholm Convention](#) on Persistent Organic Pollutants is a global treaty to protect human health and the environment from highly dangerous, long-lasting chemicals, by restricting and ultimately eliminating their production, use, trade, release and storage.

ANNEXES

1. ASSESSMENT TOOL FOR HCWM
2. MATURITY MODEL
3. KEY STAKEHOLDERS
4. TECHNOLOGY AND EQUIPMENT OVERVIEW
5. GUIDE TO SELECTING THE MOST SUITABLE WASTE TREATMENT TECHNOLOGY



ANNEX 1

ASSESSMENT TOOL FOR HCWM

Use this planning tool with key HCWM stakeholders to apply information from this guide to map out needs and priorities for your next proposal or application if requesting support for HCWM. Use a separate sheet if more space is needed.

1. What is your ranking on the maturity model? See [Section 4](#) of this document for the details of how to use the maturity model.

| | AREA | LEVEL RANKING (Level 1–5, lowest to highest) |
|------------|--|---|
| PEOPLE | Awareness, training and supportive supervision | |
| | Adherence and compliance | |
| PROCESSES | National policy/ strategic plans | |
| | Budget and Planning | |
| | Practical guidance | |
| TECHNOLOGY | Technology and equipment availability and use | |
| | TOTAL | |
| | Divide by 6 (number of areas) | /6 |
| | OVERALL SCORE | |

2. When was the last HCWM operational assessment completed? _____ (year)

Note: If more than 5 years ago, consider including this as an activity in your Gavi proposal.

3. How much waste by category of risk and type of material is generated in your country segregated by region? *Note: to the extent possible, this should reflect the entire HCWM system, not only immunisation. If this information is not currently available in reports or recent assessments, some estimate guidelines are included below. Consider including an operational assessment, waste auditing and/or composition study in your proposal.*

| TYPE OF WASTE | QUANTITY/KG PER MONTH | GEOGRAPHIC REGION |
|--|-----------------------|-------------------|
| Infectious waste | | |
| Sharps | | |
| Chemical radioactive (highly infectious) | | |
| General waste (non-hazardous) | | |

High level calculation guidance for estimating waste quantity:

- » Incinerator: capacity is typically 50–200 kg/cycle, assuming 6-8 cycles per day if functioning well.
- » WHO health care waste estimates for African countries (assumption that volumes will be higher in more urban, more developed settings; assumption that 10% of this waste is infectious, 5% is highly infectious):
 - » Primary health clinic: 0.1 kg/patient per day
 - » Small district hospital: 1.0 kg/bed per day
 - » General hospital: 2.0 kg/bed per day
 - » Major hospital: 5 kg/bed per day
- » Sharps for immunisation: a typical safety box used in health facilities is 5 litres which is estimated to hold 80–100 syringes, weighing 1.2–1.4 kg. Transport and disposal of safety boxes should be budgeted for within the overall WM system.

4. What is the current inventory of treatment and disposal equipment across the health care system and health programs, including for the immunisation program? *Note: add more lines as necessary.*

| TYPE (AUTOCLAVE, INCINERATOR, SHREDDER, ETC.) | QUANTITY | GENERAL GEOGRAPHIC PLACEMENT |
|---|----------|------------------------------|
| | | |
| | | |
| | | |
| | | |

- 4.1. At a high level, where are the geographic gaps in accessibility to these technologies and equipment across the health sector? Where does the volume of waste (from question 3) not match the expected capacity of the treatment and disposal equipment?

5. What private sector companies are involved in waste management in your country? Are there opportunities to further develop this public-private partnership?

6. What is currently included in your annual domestic resources and budget for HCWM?

7. What other sources of financial support for HCWM are available in the country? *Note: in your proposal document additional resources, donors, projects, private sector engagement and the collaboration among all stakeholders to ensure complementary efforts and reduce duplication.*

8. Looking at your score from the maturity model and your answers to the previous questions, what are the immediate opportunities in each of the three system areas. *Note: Review [Section 5](#) to think broader than just buying equipment and explore innovations and promising practices that may be appropriate for your country. For example, if you scored low on the “Policy and Strategic Plans” area of the maturity model, consider revising policies as part of your proposal. Or if health care worker knowledge and adherence to best practices is low, consider integrating HCWM training into on-the-job training and supervision.*

| PEOPLE | PROCESSES | TECHNOLOGY |
|--------|-----------|------------|
| | | |
| | | |
| | | |
| | | |

These should be included in your Gavi application (if external funding is needed) or in your annual workplan (for example, for updating policies or clarifying guidance).

9. What are longer-term opportunities that may require more strategic planning, systems building, and/or private sector engagement?

| PEOPLE | PROCESSES | TECHNOLOGY |
|--------|-----------|------------|
| | | |
| | | |
| | | |
| | | |

ANNEX 2 MATURITY MODEL

Note: Review [Section 4](#) for guidance on use

| | AREA | LEVEL 1 | LEVEL 2 | LEVEL 3 | LEVEL 4 | LEVEL 5 |
|------------|---|---|--|---|--|--|
| PEOPLE | Awareness, training and supportive supervision | Low level of awareness of risk associated with HCW (less than 40%) | Moderate awareness of risk associated with HCW; curriculum developed but not fully rolled out (implemented in 41%–50% of facilities) | A significant proportion of health workers and waste handlers (51%–75%) are trained on the risks associated with HCW and clear guidance on HCWM is available at most facilities | High level of awareness of HCW risk. 76%–85% health care workers and waste handlers have undergone training and have access to on-going training | More than 85% of health workers and waste handlers are trained and are aware of risks associated with HCW and demonstrate BEP. HCWM is included in supportive supervision activities |
| | Adherence and compliance | Little insight into adherence of best practices for HCWM | Have insight and best practice of HCWM available (SOPs and job aids) but not practiced (less than 50% of facilities adhere and comply) | Best practices of HCWM being adhered to in at least half of the facilities; minimal M&E in place | Significant compliance to the best HCWM practices. M&E framework in place with some tracking of adherence | Country fully adheres to the best practices; M&E framework tracks adherence to policies and guidance |
| PROCESSES | National policy/ strategic plans | Policy is needed or currently being developed. No recent HCWM assessment carried out (within the last 5 years) | Policy developed and/or reviewed within the last 5 years. HCWM assessment carried out within the last 5 years | Policies and guidelines are disseminated and partially adopted | Country can show that the policies and guidelines are fully implemented at all levels of the system | Policies widely adopted across the country. Evidence that WM performance gaps are addressed in strategic planning and financing mechanisms at national and sub-national levels. |
| | Budget and planning | HCWM is not planned and budgeted | Budgeted but not directly linked to realistic needs or assessment findings | At least half of facilities develop a HCWM budget and implement specific plans | Budgets are available, funded and tracked at 75% of system levels | HCWM is 100% budgeted at national and sub-national levels |
| | Practical guidance | Need, or currently being developed | Guidance developed but not fully in use (used in less than 50% of the facilities) | Guidance is developed and in use in 50%–65% of the facilities within the country | Guidance is available and being implemented at most (65%–85%) system levels | Guidance is available and in use at more than 85% of facilities within the country |
| TECHNOLOGY | Technology and equipment availability and use | Not aware of BAT and BEP. Out-of-date, inefficient, non-environmentally friendly options for treatment and disposal | Awareness of the recommended BAT and BEP options but still using out-of-date equipment and technology | Some BAT equipment available at 50% of facilities (or 50% accessing services) and/or at least 50% of the waste being generated is treated and disposed using globally accepted technologies | Globally accepted equipment is widely (more than 51%) available; most facilities are clustered and mapped to an acceptable treatment technology | Only efficient and BAT used to manage HCW. Environmental monitoring of waste treatment and disposal done in compliance with national and/or global standards |

ANNEX 3

KEY STAKEHOLDERS

List of key stakeholders developed by Global Fund, Technical Brief: Sustainable Healthcare Waste Management (January 2020).

| SECTOR | STAKEHOLDER | ROLE |
|----------|--|---|
| PUBLIC | Ministry of Environment | <ul style="list-style-type: none"> » Enactment of waste management legislation » Waste management regulation and enforcement » Development of regulatory guidance » Development of national waste management strategy and policy |
| | Ministry of Health | <ul style="list-style-type: none"> » Development of health care waste management standards » Establishment of HCWM standards » Regulation, enforcement and monitoring of HCWM compliance |
| | Ministry of Finance | <ul style="list-style-type: none"> » Establishment of waste management financial plan |
| | Department of Transport | <ul style="list-style-type: none"> » Establishment of waste transport standards » Regulation, enforcement and monitoring of waste transport activities |
| | Drug Administrator | <ul style="list-style-type: none"> » Regulation of drug testing, development and marketing process |
| | Regional and Local Authorities (e.g. state and district level) | <ul style="list-style-type: none"> » Implementation of national HCWM policy » Development of local plans and targets » Governance of local waste management contracts (e.g. collection and/or disposal) |
| | Health care facility | <ul style="list-style-type: none"> » Management of HCW at source » Compliant segregation and storage |
| PRIVATE | Waste collection service provider | <ul style="list-style-type: none"> » Collection of health care wastes under contracted or 'paid for' service |
| | Waste treatment and/or disposal service provider | <ul style="list-style-type: none"> » Treatment and/or disposal of healthcare wastes under contracted or 'paid for' service |
| | Health care facility | <ul style="list-style-type: none"> » Management of HCW at source » Compliant segregation and storage |
| INFORMAL | Community based waste collection and disposal service provider Communities | <ul style="list-style-type: none"> » Collection, treatment and disposal of healthcare wastes through informal or ad-hoc arrangements » Development and implementation of awareness raising campaigns » Local recycling and reuse initiatives |

| | | |
|-------------------------------------|--|--|
| FINANCING ORGANIZATIONS | Investors | » Provision of loans or equity to implement new waste infrastructure |
| | Financing institutions (e.g. World Bank, European Investment Bank, etc.) | » Provision of grants and/or long-term loans to support capital investments in new waste infrastructure |
| FUNDING AND TECHNICAL ORGANIZATIONS | WHO, UNDP, CDC, Red Cross, Gavi, UNEP | » Provision of funds to implement waste management interventions and sourcing of health products » Development of HCW guidance at international level |

ANNEX 4

TECHNOLOGY AND EQUIPMENT OVERVIEW




There are numerous options for different types of treatment and disposal technologies:

- » Autoclaves
- » Hybrid autoclave systems
- » Continuous steam treatment systems
- » Batch microwave technologies
- » Continuous microwave technologies
- » Frictional heat treatment systems
- » Dry heat treatment systems
- » Incinerators and related technologies
- » Alkaline hydrolysis technologies
- » Chemical treatment systems

Additional detail on these technologies and others can be found in ICET's [Compendium of Technologies for Treatment/Destruction of Health care Waste](#), which also provides guidance on selecting the specific technologies that are most appropriate for your context. This section includes only a high-level summary of the most common equipment available in low and middle-income countries that are seen as best available techniques and meet best environmental practices. This guide does not endorse any specific technology or company.

AUTOCLAVE SHREDDER

Uses pressurized steam to decontaminate infectious waste.

| | |
|---|--|
|  Key Features | <ul style="list-style-type: none">» Two-stage treatment process comprising autoclave sterilization followed by mechanical shredding» Thermal process» Achieves both decontamination of waste and volume reduction» Temperatures of 121°C for at least 30 minutes |
|  Capacity of Equipment | <p>Autoclave:</p> <ul style="list-style-type: none">» Range: 200–2000L» App. 25–150kg per cycle» Each cycle is approximately one hour; maximum of 8 cycles per day <p>Shredder:</p> <ul style="list-style-type: none">» Capacity will vary depending of type (speed & torque) and throughput |
|  Total Cost of Ownership | <ul style="list-style-type: none">» Large system for regional referral hospital: US \$150,000–\$300,000 (including housing, water and drainage and electricity) |



Additional Considerations

- » Requires housing structure on site with proper ventilation and drainage/ sewer connection or septic tank
- » Reliable electric power supply
- » Regular supply of clean soft water
- » Plan for adequate supply of autoclave bags
- » Rigorous monitoring of the sterilization process for each cycle
- » Adequate waste storage facilities for pre- and post-treatment
- » Skilled operator required
- » Technical support for routine preventive maintenance
- » Final disposal of treated waste should be planned for at conception stage. This is to avoid burning waste after treatment.

Modern Autoclaves



MICROWAVE SHREDDER

Kills infectious agents through heat and pressure, not as a result of exposure to microwaves. Shredding can be combined with microwaving to reduce volume and to increase the surface area of contact between waste and disinfectant.



Key Features

- » Waste are exposed to a temperature over 100°C–110°C by High Frequency microwave
- » 6–8 log₁₀ microbial inactivation
- » Efficient heating rises up to 110°C for 20' to obtain a full decontamination
- » Adapted to any type of medical waste (sharps, glass, solid, liquid)



Capacity of Equipment

- » Range: 35 -500Kg/cycle
- » Each cycle—one hour



Total Cost of Ownership

- » US \$80,000–US \$1,200,000







Additional Considerations

- » Requires housing structure on site with proper ventilation and drainage/ sewer connection or septic tank
- » Reliable and stable electric power supply
- » Regular supply of clean soft water
- » Monitoring of the sterilization process for each cycle
- » Adequate waste storage facilities for pre- and post-treatment
- » Skilled operator required
- » Technical support for routine preventive maintenance
- » Final disposal of treated waste should be planned for at conception stage

Microwave shredder from Ecosteryl

INCINERATOR WITH POLLUTION CONTROL

Burns waste material at a high temperature until it is reduced to ash. Best when combined with air pollution control equipment. Most small-scale incinerators do not reach the recommended temperature, residence time, or pollution control required for proper HCWM.

| | |
|---|--|
|  <p>Key Features</p> | <ul style="list-style-type: none"> » Operating temperatures >850°C » Excess of oxygen (>6 %) » Secondary chamber smoke retention time > two seconds » Double chamber diesel-fired incinerator incorporating air pollution control device » Chimney stack of adequate height in compliance with national regulations » Housing to include waste staging area » Protected ash pit for disposal of bottom ash and prevent the pollution of underground water » Decontamination of waste and reduction of volume achieved |
|  <p>Specific Parts</p> | <ol style="list-style-type: none"> 1. A waste feeding system 2. A primary chamber where waste is loaded 3. Secondary chamber where smoke coming out of the primary chamber is burnt 4. A flue gas purification system 5. A slag treatment system. |
|  <p>Capacity of Equipment</p> | <ul style="list-style-type: none"> » Range: 50 – 200 Kg/ cycle; six– eight cycles per day |
|  <p>Total Cost of Ownership</p> | <ul style="list-style-type: none"> » US \$75,000–\$150,000 |



Additional Considerations

- » Siting away from residential and agricultural areas
- » Plan for provision of housing with adequate storage for waste
- » Siting of ash pit and lining to protect underground water
- » Trained operator
- » Regular/adequate supply of fuel
- » Reliable electricity supply
- » Regular environmental monitoring to mitigate air pollution

Refer to [WHO incinerator guidance](#) for additional information

Example of incinerator



ANNEX 5

GUIDE TO SELECTING THE MOST SUITABLE WASTE TREATMENT TECHNOLOGY

Once your project is funded, collaborate with key stakeholders across the health care waste management spectrum in working through these steps to analyse, procure, contract, and install new waste treatment equipment. (Taken from: [Compendium of Technologies for Treatment/Destruction of Healthcare Waste](#)).

| | TASK | ACTIVITIES |
|---------------|--|--|
| STEP 1 | Define the scope of the waste management problem, collect baseline data and consult stakeholders | <ul style="list-style-type: none"> » Conduct a situation analysis » Conduct a baseline assessment and collect data on characteristics of waste and issues related to its management » Present data to stakeholders and let them make input |
| STEP 2 | A meeting of planners, decision makers and elected representatives will be held to decide on waste management approaches | <ul style="list-style-type: none"> » Use decentralized system to engage key stakeholders from all levels of the system » Form clusters of waste management systems » Centralized system for waste management |
| STEP 3 | Collect additional data from the health facilities to better understand what the system will look like | <ul style="list-style-type: none"> » Amount of waste generated by type or category » Costs for waste management commodities » Costs for power/energy consumption » Costs for water consumption » Costs for water collection and transportation » Costs for land disposal » Costs for diesel/gas » Costs for personal protective equipment » Costs for data collection » Costs for new equipment, including training requirements and maintenance |
| STEP 4 | Conduct a screening process to eliminate technologies that do not meet basic criteria. Stakeholders should guide this process | <ul style="list-style-type: none"> » Adheres to both local government and national laws/regulations in health and environment » Conforms to WHO policy papers on health care waste management » Conforms to Basel Convention technical guidelines for environmentally sound management of bio-medical waste » Conforms to Stockholm Convention technical guidelines on best available technologies and provisional guidance on best environmental practices |

| | TASK | ACTIVITIES |
|---------|--|---|
| STEP 5 | Conduct a scoping analysis to generate a list of potential technologies based on preferred criteria | <p>Possible Considerations:</p> <ul style="list-style-type: none"> » Impact of the technology on the environment; minimal, some, or significant concerns » Impact on occupational health and safety concerns; minimal, some, or significant concerns » Potential for job creation based on equipment size: small, medium, large » Social acceptance concerns; minimum, some, high » Capital operating costs; low, medium, high » Institutional requirements; few, some, many » Regulatory requirements; few, some, many » Range of capacities » Range of types of waste that can be treated » Efficacy of anti-microbial inactivation » Volume and mass reduction » Space needed for installation » Other installation requirements » Degree of automation |
| STEP 6 | Conduct a detailed technical and economic assessment to produce a ranking of technologies | <ul style="list-style-type: none"> » Set up a minimum cut-off point, and all technologies scoring above that mark can be put on the list of technologies that can be selected » The top three to five can be included on this list » Before discarding the rest of the technologies, check to see if technology transfer would improve their ranking |
| STEP 7 | Review the results and prepare a written justification why the selected technologies were the preferred. The process can be repeated if unsure | <ul style="list-style-type: none"> » Summarize selection criteria |
| STEP 8 | Contract award | <ul style="list-style-type: none"> » Lowest bidder » Bidder that meets the award criteria |
| STEP 9 | Installation and commissioning | <ul style="list-style-type: none"> » Shipment » Installation » Testing » User training » Commissioning |
| STEP 10 | Monitoring and evaluation | <ul style="list-style-type: none"> » Generate a list of performance indicators that will be used during monitoring and evaluation |

This guidance for preparing a HCWM proposal was developed through consultation with GAVI, UNICEF, WHO, Global Fund, JSI and UNDP

